BRIEF

Can Data Centers Heat Our Buildings?

Using Thermal Energy Networks to Reuse Data Center Waste Heat

BUILDING DECARBONIZATION COALITION

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BUILDING DECARBONIZATION COALITION

The Building Decarbonization Coalition (BDC) aligns critical stakeholders on a path to transform the nation's buildings through clean energy, using policy, research, market development, and public engagement. The BDC and its members are charting the course to eliminate fossil fuels in buildings to improve people's health, cut climate and air pollution, prioritize high-road jobs, and ensure that our communities are more resilient to the impacts of climate change.

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Introduction

Data centers are multiplying to meet the world's growing demand for digital services, and many local leaders see this as an opportunity to attract investment to their regions. But data centers can also burden host communities. They use vast amounts of electricity to power their equipment, which strains the electric grid and the utility customers that support its maintenance. This constant electricity use then heats up the building, requiring water-intensive cooling systems to consume even more energy to expel that "waste heat" into the atmosphere.

This waste heat is an untapped opportunity. When data centers transition to clean electricity, capturing and redistributing their heat can accelerate decarbonization in surrounding buildings and neighborhoods. By connecting data centers to thermal energy networks (TENs), communities and commercial districts turn this waste byproduct into an efficient heat source, reducing fossil fuel consumption and delivering tangible benefits to surrounding neighborhoods.

In Sweden, Denmark, and Ireland, data centers are already integrated into city district heating systems, supplying heat to thousands of homes and reducing citywide emissions. In the United States, TENs incorporating data centers are operational on campuses and downtown business districts, and regulated utilities are exploring pathways for data centers to heat apartments in urban neighborhoods.

As data centers grow in size and move into new communities, local leaders must solve their energy, heat, and water demands. Existing projects and policy show that, with appropriate planning, engineering, and engagement, TENs can use one building's waste heat to benefit other buildings and support an area's broader decarbonization efforts.

When Data Centers Come to Town

Currently, the U.S. hosts more than 5,000 data centers, the highest number of any country worldwide.[1] And that number is increasing. In 2024, the global data center construction market was valued at an estimated $240.97 billion, and anticipated to grow significantly until 2030.[2]

Data centers vary widely in size and scale. Some can fit into a single office building's server room, located close to the building's users to save energy and reduce latency (computer lag time). Commonly referred to as "edge" data centers, these smaller facilities are found in cities, campuses, or business districts, and can be located within residential or commercial buildings.[3] Hyperscale data centers are massive facilities that can consume as much power as a mid-size city. Their large size means they are typically located outside of dense urban developments.

Energy-intensive AI and cloud computing has "supercharged" the growth of hyperscale data centers.[4] [5] Developers must strategically site their facilities according to a wide range of factors: power reliability, proximity to fiber optic networks, an area's energy costs, regional climate, water supply, land costs, municipal support, labor availability, tax incentives, and much more.[6]

Meanwhile, many local leaders see financial benefits to hosting data centers in their jurisdictions. In 2023, data centers contributed $733 million in tax revenue to Loudon County, Virginia, and are estimated to add $9.1 billion to the state's GDP annually.[7] In Oregon, local leaders pointed to property tax contributions from Amazon's data centers as a key source of funding for public services like schools, a fire engine, and grants for home buyers.[8] The opportunity cost of losing data centers to neighboring states and municipalities can be a powerful motivator, with many cities and counties offering tax incentives for data center owners in the hopes of securing long-term economic gains.

But despite their revenue potential, data centers strain local resources, can undermine climate goals, and exacerbate environmental injustice.[9]

It is well-known that data centers are massive electricity consumers. This level of new demand introduces significant stress to an area's electric grid, and building the new infrastructure needed to support it may increase electricity bills for all utility customers.[10] To maintain an uninterrupted power supply, data centers may incorporate onsite diesel or methane gas generators, which emit harmful, climate-warming pollutants that affect air quality and community health.[11] [12]

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[1] Cloudscene. North America. Accessed June 2, 2025. https://cloudscene.com/region/datacenters-in-north-america.

[2] Grand View Research. Data Center Construction Market Size, Share, & Trends Analysis Report By Infrastructure (IT Infrastructure, PD and Cooling Infrastructure, Miscellaneous Infrastructure), By Tier Type, By Verticals, By Region, And Segment Forecasts, 2025–2030. Market Analysis Report. https://www.grandviewresearch.com/industry-analysis/data-center-construction-market.

[3] Torpey, Neil, and Stuart Blythe. Edge and Hyperscale Data Centers in the AI Era: Explosive Demand and Important Risks. Data Center Knowledge, January 8, 2025. Accessed June 9, 2025. https://www.datacenterknowledge.com/hyperscalers/edge-and-hyperscale-data-centers-in-the-ai-era-explosive-demand-and-important-risks.

[4] Ibid.

[5] Synergy Research Group. Hyperscale Data Center Capacity to Triple by 2030, Driven by Generative AI. January 9, 2025. Accessed June 9, 2025. https://www.srgresearch.com/articles/hyperscale-data-center-capacity-to-triple-by-2030-driven-by-generative-ai.

[6] Hispa, Yoann. "Factors to Consider for Data Center Site Selection." Landgate, June 17, 2024. https://www.landgate.com/news/factors-to-consider-for-data-center-site-selection.

[7] Virginia State Legislature. Senate Bill 1449: Data Centers; Site Assessment for High-Energy-Use Facility (Governor's Veto). 2025. Accessed June 9, 2025. https://lis.virginia.gov/bill-details/20251/SB1449/text/SB1449VG.

[8] "Data Centers Proliferate Nationwide, Encroaching on Cities, Suburbs." CBS News, December 5, 2024. https://www.cbsnews.com/news/data-centers-cities-suburbs-expansion/.

[9] Sierra Club Michigan Chapter. "Data Centers, An Important Emerging Issue in Michigan." Sierra Club, April 4, 2024. https://www.sierraclub.org/michigan/blog/2024/04/data-centers-important-emerging-issue-michigan.

[10] Martin, Eliza, and Ari Peskoe. Extracting Profits from the Public: How Utility Ratepayers Are Paying for Big Tech's Power. Environmental & Energy Law Program, Harvard Law School, March 2025. https://eelp.law.harvard.edu/wp-content/uploads/2025/03/Harvard-ELI-Extracting-Profits-from-the-Public.pdf.

[11] Cohn, Lisa. Why Do Data Center Operators Choose Diesel Backup over Cleaner Microgrids? Microgrid Knowledge, February 4, 2022. Accessed June 9, 2025. https://www.microgridknowledge.com/distributed-energy/article/11427459/why-do-data-center-operators-choose-diesel-backup-over-cleaner-microgrids..

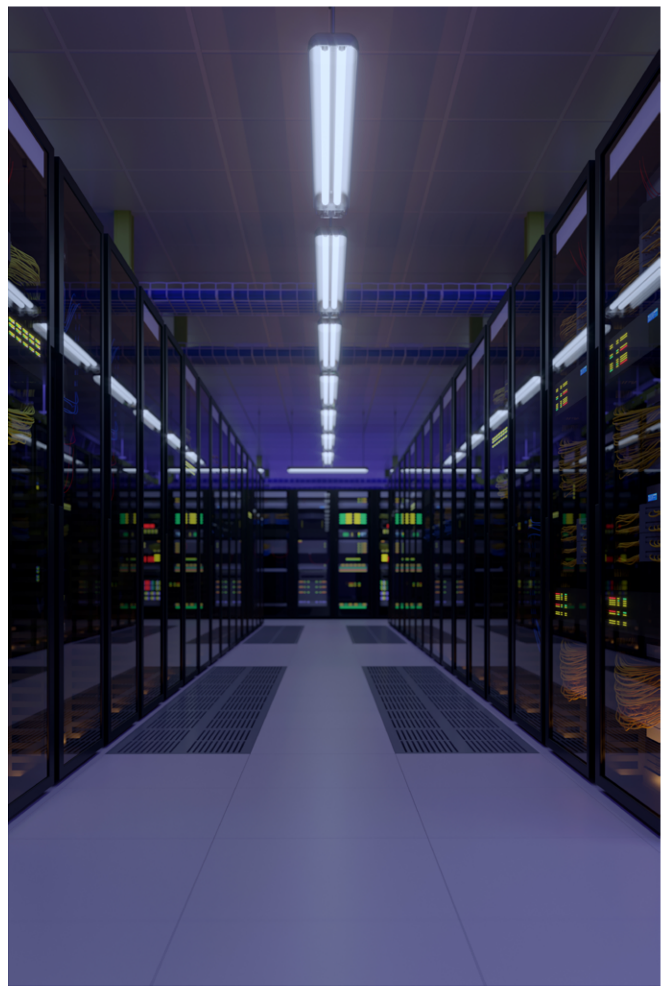
[12] Gas Turbine World. "Data Centers Fueling Gas Turbine Sales." July 24, 2024. https://gasturbineworld.com/data-centers-fueling-gas-turbine-sales/.

Additionally, the servers within data centers need to stay cool to function, an imperative that requires energy and water. Many facilities rely on systems of chillers and cooling towers, which use a water-intensive process to evaporate heat into the atmosphere. In the U.S., some data centers can use between 3 to 5 million gallons of water per day—enough to supply 30,000 to 50,000 people.[13]

The xAI data center in Memphis, Tennessee, exemplifies all of these tensions. Southwest Memphis has a long history of industrial pollution and environmental injustice.[14] [15] While Memphis Mayor Paul Young described bringing xAI to Memphis as "a tremendous opportunity...for us to take our economy to the next level," residents were both surprised and alarmed by the company's arrival to their town.[16] The data center's primary building is the size of 13 football fields; its expected water demand is more than 5 million gallons per day; and its use of methane gas turbines for backup power generation has drawn sharp criticism in an area already burdened by air pollution.[17] [18]

As data center developers and technology companies seek new sites for hyperscale facilities or expand the capacity of smaller facilities, local leaders will certainly seek to secure financial benefits for their constituents from these investments. But to site data centers responsibly, leaders must shift their line of questioning beyond How can we bring data centers here? to How can we reduce potential burdens and maximize all potential benefits of a data center? Answering that question requires intentional planning and proactive policy to shape responsible digital infrastructure.

With appropriate planning and engagement, TENs offer one pathway toward that outcome.



[13] Solon, Olivia. Drought-Stricken Communities Push Back Against Data Centers. NBC News, June 19, 2021. Accessed June 9, 2025. https://www.nbcnews.com/tech/internet/drought-stricken-communities-push-back-against-data-centers-n1271344.

[14] Menon, Shanti. "Meet KeShaun Pearson, Champion of Change." Environmental Defense Fund, March 27, 2025. https://vitalsigns.edf.org/story/meet-keshaun-pearson-champion-change?conversion_pg=www.momscleanairforce.org%2Fkeshaun-pearson%2F.

[15] Memphis Community Against Pollution. "Our Mission." Accessed June 2, 2025. https://www.memphiscap.org/aboutmcap.

[16] Harries, Bracey, Jon Gerberg, and Stephanie Gosk. "Musk's xAI Colossus Supercomputer in Memphis Sparks Concerns." NBC News, June 2, 2025. https://www.nbcnews.com/news/us-news/musk-xai-colossus-supercomputer-boxtown-memphis-tennessee-rcna206242.

[17] Chow, Andrew. "Elon Musk's xAI Expands with Memphis Supercomputer Facility." Time, September 14, 2024. https://time.com/7021709/elon-musk-xai-grok-memphis/.

[18] Protect Our Aquifer. xAI Supercomputer. Accessed June 9, 2025. https://www.protectouraquifer.org/issues/xai-supercomputer/.

TENs and Data Centers: Don't Waste the Heat

Thermal energy networks (TENs) use a shared network of water-filled pipes to transfer heat in and out of multiple buildings. These systems allow buildings to exchange heat with a number of thermal energy sinks and sources, such as water bodies, energy-intensive industries, wastewater systems, or the ground. Each building on a TEN uses heat pumps to transfer energy between the network and the building; therefore, as long as all connected energy sources are fossil fuel-free, there is no onsite combustion in a TEN.

Geothermal Power Production, Thermal Energy Networks, & Data Centers

There is growing interest in using geothermal power to generate clean electricity, especially to meet the rising electricity demands of data centers. But there are important distinctions between geothermal power plants and thermal energy networks (TENs).

Geothermal power plants access ultra-hot temperatures (300°F–700°F), often deep underground, to generate clean, renewable electricity. TENs do not generate electricity. Instead, they circulate low-temperature thermal energy in underground pipes to heat and cool buildings. Some TENs also use shallow boreholes to access the mild temperature of the earth just below the surface, which is around 55°F in much of the United States. In this way, the ground acts as a heat source for heating and a heat sink for cooling.

As we decarbonize the electric grid and the built environment, thermal energy in all of its forms and temperatures will play an important role. Clean electricity is essential to meeting climate goals and reducing pollution. Once that clean electricity is in use, TENs can help ensure that the waste heat it creates is redistributed in the form of usable thermal energy for buildings. This brief focuses specifically on TENs and their potential to use waste heat for building decarbonization.

TENs are designed opportunistically to use the heat resources of a location, and waste heat from a data center is a valuable resource: it is recoverable and, because data centers function 24/7, it is constant. Integrating a data center into a TEN thus transforms data centers from isolated energy consumers into active contributors to a community's energy ecosystem.

~40% of a data center's total energy is consumed by cooling systems. Nearly all of this energy converts into heat.

The crux of this contribution lies at the transformation of electricity into heat. A data center draws nearly nonstop energy to power its various components, including servers, computer room air conditioning units and cooling technologies, uninterruptible power supply systems, lighting, and other auxiliary systems. IT equipment accounts for over half of the total electricity usage, while cooling systems consume approximately 40% of a data center's total energy.[19] Nearly all of this energy converts into heat; cooling systems then play a crucial role in dissipating the heat to the external environment to maintain optimal indoor air temperature for IT equipment.[20] This process creates waste, constantly consuming more energy to expel the inevitable thermal energy it makes.

However, if this thermal energy can be captured and repurposed, it can be transformed from a waste byproduct into a valuable energy source that reduces strain on the grid. Utilizing waste heat from data centers is an innovative, effective approach to enhancing energy efficiency and lowering emissions.[21]

When a data center connects to a TEN, its waste heat is no longer discarded. Instead, it is transferred into the network's pipes. The pipes move the heat where it is needed or wanted. It may travel directly to buildings that need warmth right away, or it can be transferred to shallow boreholes in the ground or other form of storage for later use. (The ground can be an efficient heat sink, and stored thermal energy may be retrieved weeks or months later).[22]

A diagram of a thermal energy network.

> **"Integrating a data center into a TEN thus transforms data centers from isolated energy consumers into active contributors to a community's energy ecosystem."**

[19] U.S. National Renewable Energy Laboratory. Reducing Data Center Peak Cooling Demand and Energy Costs With Underground Thermal Energy Storage. By Alyssa Bersine. January 17, 2025. Accessed June 9, 2025. https://www.nrel.gov/news/detail/program/2025/reducing-data-center-peak-cooling-demand-and-energy-costs-with-underground-thermal-energy-storage.

[20] He, Zhiguang, et al. "Analysis of a district heating system using waste heat in a distributed cooling data center." Applied Thermal Engineering, vol. 141, Aug. 2018, pp. 1131–1140, https://doi.org/10.1016/j.applthermaleng.2018.06.036.

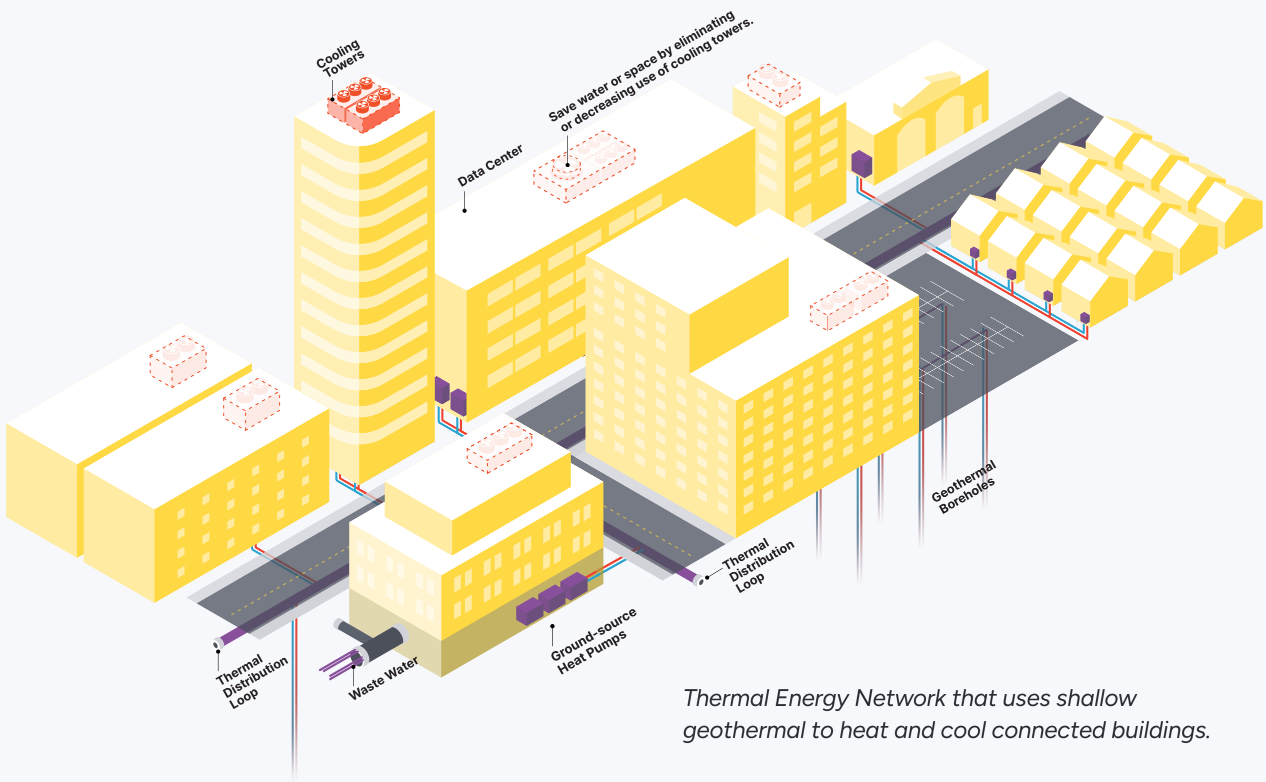
[21] Zhang, Caiqing, et al. "An economic analysis of waste heat recovery and utilization in data centers considering environmental benefits." Sustainable Production and Consumption, vol. 31, May 2022, pp. 127–138, https://doi.org/10.1016/j.spc.2022.02.006.

[22] Camargo, Ana Maria, Jessica Silber-Byrne, Audrey Schulman, and Zeyneb Magavi. The Future of Heat: Thermal Energy Networks as an Evolutionary Path for Gas Utilities Toward a Safe, Equitable, Just Energy Transition. Presented at ACEEE 2024 Summer Study on Energy Efficiency in Buildings, August 2024. Building Decarbonization Coalition. Accessed June 9, 2025. https://buildingdecarb.org/resource/the-future-of-heat-thermal-energy-networks-as-an-evolutionary-path-for-gas-utilities-toward-a-safe-equitable-just-energy-transition.

Reusing waste heat for space or water heating is inherently more energy-efficient than generating new heat, so other buildings on the TEN immediately benefit from the data center's excess. If surrounding buildings previously heated with gas, oil, or propane furnaces, they switch to heat pumps to access the data center's heat. In the process, these buildings eliminate onsite combustion for heating and reduce their own emissions.[23] If surrounding buildings previously relied on electric resistance heating, transitioning to heat pumps will significantly decrease their electricity consumption. In either scenario, a single data center's waste thus becomes a shared resource to decarbonize and/or increase energy efficiency in an entire district or neighborhood.

Efficient heating translates into grid-scale benefits. As AI, cloud computing, and other digital products place greater demand on electric grids, reusing the energy we already create and adopting high-efficiency appliances are crucial grid protection strategies: an electron saved through energy efficiency measures is equal to an electron generated.

Geothermal heat pumps, in particular, are highly efficient technologies, capable of delivering an average of four units of heating or cooling for each unit of electricity consumed.[24] Research from Oak Ridge National Laboratory found that mass geothermal heat pump deployment could avoid 24,500 miles of new transmission lines by 2050, saving an estimated $557 billion in grid buildout costs.[25] This study focused on individual geothermal heat pumps, but when connected to a TEN, individual heat pumps become even more efficient due to the capture and trade of thermal energy, generating potentially six units of heating or cooling for every unit of electricity consumed.[26]



Thermal Energy Network that uses shallow geothermal to heat and cool connected buildings.

[23] Zhang, Caiqing, et al. "An economic analysis of waste heat recovery and utilization in data centers considering environmental benefits." Sustainable Production and Consumption, vol. 31, May 2022, pp. 127–138, https://doi.org/10.1016/j.spc.2022.02.006.

[24] Silber-Byrne, Jess. "Affordable Heat, Efficient Grid." Building Decarbonization Coalition, September 19, 2024. https://buildingdecarb.org/why-efficiency-matters.

[25] Liu, Xiaobing, Jonathan Ho, Jeff Winick, Sean Porse, Jamie Lian, Xiaofei Wang, Weijia Liu, Mini Malhotra, Yanfei Li, and Jyothis Anand. Grid Cost and Total Emissions Reductions Through Mass Deployment of Geothermal Heat Pumps for Building Heating and Cooling Electrification in the United States. No. ORNL/TM-2023/2966. Oak Ridge National Laboratory (ORNL), Oak Ridge, TN (United States), 2023. https://info.ornl.gov/sites/publications/Files/Pub196793.pdf.

[26] Silber-Byrne, Jess. "Affordable Heat, Efficient Grid." Building Decarbonization Coalition, September 19, 2024. https://buildingdecarb.org/why-efficiency-matters.

Data centers that redistribute waste heat through a TEN can also drastically reduce their water consumption. Waste heat no longer needs to be evaporated in cooling towers; instead, it is captured for the larger network. In *Building Decarbonization Meets Water Conservation*, we compared the water usage data of eight TENs, finding that these systems saved a combined 337 million gallons annually—equivalent to 3,000 U.S. households.[27]

Policy: Maximizing Benefits, Minimizing Burdens

Policymakers are beginning to address the complex landscape of governing and regulating data centers' energy use. In 2025, multiple states proposed laws related to data centers and energy efficiency, electric ratepayer protection, and renewable electricity (**see Appendix I**).[28] [29] Policy can similarly guide data center waste heat recovery, encourage forward-thinking engineering, and require transparent stakeholder engagement.

Waste heat recovery mandates

Germany's Energy Efficiency Act of 2023 is a possible model for encouraging waste heat recovery. The law requires new data centers to reduce the production of waste heat and make unavoidable waste heat available to district heat suppliers (with some exemptions).[30] Local governments in the U.S. might similarly require new data centers to demonstrate waste heat utilization plans. Siting policies could encourage data center placement near industrial buildings or legacy district heating systems that currently rely on combustion technologies, allowing these industries or central heating plants to decrease their emissions.

Designing for thermal readiness

Because data center construction and community infrastructure projects, like TENs, move on different timelines, early developer preparation can ensure that physical infrastructure is in place for future heat recovery and sharing. Policymakers can ask data center developers from the outset to demonstrate the "thermal readiness" of their buildings by designing facilities that can capture and share waste heat in a future TEN.

For example, a data center that plans to use water cooling—liquid-filled cooling loops that absorb heat from servers—can also include a dedicated, insulated pipe along its perimeter, capped and metered, to enable a future connection to a TEN. This pipe would act as a thermal outlet, allowing excess heat to be exported from the building without retrofitting the facility later. Including critical mechanisms like flow control valves, thermal meters, and heat exchangers in the initial design can ensure that once nearby buildings or a district network are developed, the infrastructure is ready to integrate, making eventual thermal sharing as simple as "plugging in" to an existing heat source.

Non-combustion requirements

While waste heat recovery is more efficient than generating new heat through combustion, the ability to recover waste heat should not be used to justify or greenwash polluting data centers. As advocates in Memphis and elsewhere have emphasized, a data center that burns fossil fuels to generate power can add to environmental injustice and health burdens.

Policymakers courting data center investment must be aware that, for waste heat recovery to contribute to neighborhood-scale decarbonization and provide community benefit, it should be recovered from a non-

[27] Besic, Ashley. Building Decarbonization Meets Water Conservation: The Potential of Thermal Energy Networks to Cool Buildings & Save Water. Building Decarbonization Coalition, 2024. https://buildingdecarb.org/wp-content/uploads/BDC_Water_Conservation_2024.pdf.

[28] Johnson, Khari. Crackdown on Power-Guzzling Data Centers May Soon Come in California. San Francisco Chronicle, February 18, 2025. https://www.sfchronicle.com/bayarea/article/crackdown-power-guzzling-data-centers-soon-come-20173899.php.

[29] Plautz, Jason, and Jeffrey Tomich. "State Lawmakers Grapple with Energy Demand for Data Centers." E&E News by Politico, March 3, 2025. https://www.eenews.net/articles/state-lawmakers-grapple-with-energy-demand-for-data-centers/.

[30] "Waste Heat from Data Centres - New Reporting Obligations under the EnEfG." TaylorWessing, February 6, 2025. https://www.taylorwessing.com/en/insights-and-events/insights/2025/01/abwaerme-von-rechenzentren.

combusting energy source.[31] While some utilities have claimed that increased electricity demand from data centers requires them to invest in more fossil-fueled power plants, state regulators and policymakers must require utilities to adhere to state climate laws.[32] (**See Appendix I** for recent examples of recent state legislation that address renewable electricity requirements for data centers).

In addition to primary power from utilities, many data centers supplement power from the grid with onsite generation fueled by diesel or natural gas (solar panels are less commonly used).[33] Developers have expressed long-term interest in renewable onsite generation, such as geothermal power, although this is unlikely to be viable before 2030.[34] Policy should mandate that existing data centers currently using combustion for generation must demonstrate their transition plans to clean energy usage.

Stakeholder engagement and benefit-sharing

As physically connected infrastructure, TENs require the input of multiple stakeholders. Existing TENs legislation can help shape policy approaches to stakeholder engagement for waste heat recovery with data centers.

Data center developers and tech companies, as potential anchor heat sources, should benefit from integrating waste heat recovery, clean energy generation, and TENs into their facilities. Some benefit originates outside the host community, as these companies face public and investor pressure to reduce their carbon footprints.[35] Waste heat recovery systems can address this by cutting emissions, conserving water, and making progress toward sustainability commitments. Data center owners and tenants may also be permitted to create new revenue streams in a "thermal marketplace," in which they sell surplus heat to nearby buildings and entities, creating a new revenue stream.

Policymakers can ensure that local stakeholders are involved in planning, permitting, and negotiation to ensure that tangible benefits accrue to surrounding buildings and neighborhoods. Policymakers can turn to existing TENs legislation to inform new policy approaches for data center waste heat recovery.[36] For example, Maryland requires utilities filing TEN pilot proposals to include a community benefit agreement and demonstrate how the utility's plans will benefit "customers, employees, and society at large."[37] Policymakers seeking to attract data centers could adopt similar frameworks when requesting and reviewing waste heat recovery plans from developers.

Stakeholder engagement approaches for a TEN with a data center will look different in a residential neighborhood than a college campus, commercial district, or industrial zone. All outreach processes should begin with assessing and understanding building owner and occupant priorities. Policymakers and stakeholders can then assess whether a TEN is a good fit and co-develop an implementation approach, potentially including community benefit agreements.[38] With clear planning and engagement requirements, TENs can ensure that digital infrastructure serves local communities rather than competing with them for resources.

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31 Miles, Mahal, Katie Wu, Michelle Vigen Ralston, and Johanna Partin. Thermal Energy Networks: Considerations from Environmental Justice and Energy Democracy Perspectives. Common Spark Consulting and Transformative Strategies Consulting, May 2025. https://www.transformativestrategies.net/_files/ugd/113511_8814ff1226584b2f95c5c5cbdf2be1eb.pdf

32 Beckler, Hannah, Rosemarie Ho, and Ellen Thomas. AI Runs on Dirty Power – and the Public Pays the Price. Business Insider, June 19, 2025. https://www.businessinsider.com/ai-runs-dirty-power-and-the-public-pays-the-price-2025-6

33 Bloom Energy. 2025 Data Center Power Report: From Gridlock to Growth—How Power Bottlenecks Are Reshaping Data Center Strategies. January 2025. Accessed June 9, 2025. https://www.bloomenergy.com/wp-content/uploads/2025-Data-Center-Power-Report.pdf.

34 Ibid.

35 Bucaille, Ariane. "Technology Companies Lead on Climate Concern, Action." The Wall Street Journal Risk & Compliance Journal, sponsored content by Deloitte. February 7, 2023. https://deloitte.wsj.com/riskandcompliance/technology-companies-lead-on-climate-concern-action-01675692030.

36 Camargo Cortes, Ania, Lawrence Garber, Eduardo Otero Bakai, Adam Gonzales, Samantha Privett, Sonja Rzepski, and Tracey Sharkey Collins. Thermal Energy Networks (TENs) Legislative Guidebook. Building Decarbonization Coalition and Vermont Law & Graduate School Institute for Energy & the Environment, March 20, 2025. Accessed June 9, 2025. https://docs.google.com/document/d/1rB9OR6xL9EHBtFYFV-2nXHeZ4xOKlj_PaWb66xdTQT8

37 Ibid., pages 21 and 29

38 Initiative for Energy Justice, Marisa Sotolongo. Community Benefits Policy and Energy Justice. June 2024. Accessed June 9, 2025. https://www.iejusa.org/wp-content/uploads/2024/07/Community-Benefits-Policy-and-Energy-Justice-June-2024_060524-2-1.pdf.

Existing Examples

Existing TENs show how data center waste heat can be transformed into useful thermal energy for surrounding communities, campuses, and buildings. In Sweden, Denmark, and Ireland, data centers are already integrated into city district heating systems, supplying heat to thousands of homes, reducing overall emissions, and even cutting residential heating costs (**see Appendix II**). And in the United States, utility TENs pilots are exploring ways to use existing data centers to heat and cool apartments.

Chelsea, New York, New York

Gas and electric utility Con Edison plans to develop a thermal energy network that captures waste heat from a data center and distributes it to a nearby New York City Housing Authority Complex, providing heating, cooling, and/or hot water to more than 300 apartments.[39] The project aims to provide efficient heating and cooling while reducing reliance on fossil fuels and lowering greenhouse gas emissions; construction is estimated to begin in 2025.[40]

Seattle, Washington

Amazon's headquarters repurposes waste heat from a non-Amazon data center, the neighboring Westin Building Exchange.[41] Instead of venting excess heat from its cooling towers, the Westin pipes it to Amazon, where it warms the building's offices. The system will eventually heat 5 million square feet, and is projected to save 80 million kWh of electricity over 25 years.

Dublin, Ireland

The Tallaght District Heating Scheme supplies heat harvested from an Amazon data center to South Dublin Council's County Hall building and library complex, along with buildings in the Technological University Dublin-Tallaght campus. It is owned by South Dublin City Council and operated by Heat Works, Ireland's first nonprofit energy utility.[42] The Tallaght District Heating Scheme distributed 3,770 MWh of heat and saved 1,100 tonnes of CO_2 in its first year of operation; it now saves approximately 1,500 tonnes of CO_2 annually and is set to expand in 2025, connecting 133 affordable apartments.[43] [44]

Verona, Wisconsin

Epic Systems Corporation uses a TEN to manage the year-round cooling demands of its data center while heating its corporate campus buildings. Excess heat from the data center is transferred into the ground, where boreholes serve as storage, or into the broader campus network, allowing buildings to exchange thermal energy to heat and cool. The system has reduced energy use, emissions, and operational costs.[45]

[39] ConEdison. "Our Stories: A Key to the Clean Energy Future Could Lie Under Our Feet." ConEdison, January 29, 2025. https://www.coned.com/en/about-us/media-center/news/2025/1-29/con-edison-clean-energy-future-geothermal

[40] "Con Edison Utility-Owned Thermal Energy Network Pilots: Rockefeller Center & Chelsea." Ecosystem Commercial and Residential Real Estate. Accessed June 2, 2025. https://ecosystem-energy.com/case-studies/con-edison-utility-owned-thermal-energy-network-pilots/

[41] "The Super-Efficient Heat Source Hidden below Amazon's Seattle Headquarters." About Amazon, August 20, 2019. https://www.aboutamazon.com/news/sustainability/the-super-efficient-heat-source-hidden-below-amazons-seattle-headquarters.

[42] Our Network. Heat Works. Accessed June 9, 2025. https://heatworks.ie/our-network/.

[43] "Tallaght District Heating Scheme." Codema. Accessed June 2, 2025. https://www.codema.ie/our-work/tallaght-district-heating-scheme/.

[44] Comhairle Contae Átha Cliath Theas / South Dublin County Council. Development of the Tallaght District Heating Scheme. Accessed June 9, 2025. https://www.sdcc.ie/en/climate-action/what-we-are-doing/energy-buildings/energy-buildings-actions/energy-efficiency-renewables/development-of-the-tallaght-district-heating-scheme.html.

[45] U.S. Department of Energy. Geothermal Heat Pump Case Study: Epic Systems Corporation. DOE/GO-102024-6433. September 2024. Accessed June 9, 2025. https://www.energy.gov/sites/default/files/2024-09/geothermal-heat-pump-case-study-epic-systems-corporation.pdf.

Conclusion

Data centers are expanding and evolving to meet increased digital demand, and trends predict that many more will be built in the United States. From high electricity consumption to water-intensive cooling, the challenges they present underscore the urgent need for sustainable solutions. Thermal energy networks offer one promising pathway to repurpose waste heat, reduce reliance on fossil fuels, manage an area's electricity demand, and serve surrounding communities in their own neighborhood-scale decarbonization goals.

As policymakers vie to host data centers in their states and cities, they should push data center developers to function not as energy burdens, but energy producers that contribute tangible benefits directly to surrounding communities or districts. Prioritizing waste heat recovery, clean energy solutions, and frameworks for meaningful community engagement will be essential to ensuring that the digital infrastructure of tomorrow supports both economic growth and environmental stewardship.

Now is the time for all stakeholders—local sustainability teams, city and state energy managers, tech companies, utilities, and regulators—to align on data center waste heat recovery and identify opportunities for thermal readiness in planning processes. Push for projects that demonstrate how data center waste heat can sustainably serve nearby neighborhoods. Collaborate on cross-sector frameworks that can benefit grid reliability and environmental justice. This neighborhood-scale coordination can redefine how digital infrastructure supports decarbonization—not just for buildings, but for the broader energy system in a city, commercial district, or community.

APPENDIX I: LEGISLATION AND REGULATION

Although not directly related to waste heat recovery using thermal energy networks, existing and proposed legislation and regulation of data centers shows how policymakers, regulators, and advocacy groups are thinking about data centers, ratepayer protection, and efficiency. Legislation and utility regulation can prompt data center developers to take advantage of technical solutions, like TENs, and other neighborhood-scale decarbonization approaches to ensure that data centers do not overly burden communities and utility customers.

Ratepayer Protection

Whether connected to a TEN or not, a new data center will add demand to an area's electric grid. Ratepayer advocates are concerned that utility customers will subsidize the substantial costs of strengthening the grid to support data centers, particularly hyperscale data centers.

Utilities and regulators have begun to tackle this problem through tariffs. For example, in Ohio, American Electric Power Company, Inc. has proposed a tariff requiring new data centers exceeding 25 MW to pay for at least 85% of their projected monthly energy use, ensuring their infrastructure costs are covered even if usage is lower.[46] Similarly, Nevada Energy has introduced a "Clean Transition Tariff" designed to supply large customers with dedicated access to new clean generation resources at rates that do not impact other customers. Under this tariff, Nevada Energy plans to procure 115 megawatts of renewable energy from a geothermal power plant operated by Fervo Energy, which will then be supplied directly to Google to run its data centers.[47] And in Indiana, the Indiana Utility Regulatory Commission approved modifications to Indiana Michigan Power's Industrial Power Tariff, imposing stricter contracting and financing requirements for customers with significant energy demands—specifically those requiring 70 megawatts at a single site, or 150 megawatts across multiple locations.[48] (The decision followed a settlement involving I&M, Amazon, Google, Microsoft, the Data Center Coalition, and consumer advocacy groups.[49])

New Legislative Actions

In 2025, multiple states proposed laws related to data centers and energy efficiency, electric ratepayer protection, and renewable electricity.[50] [51] Some bills seek to mitigate the impacts of data center energy demand, water consumption, and land use on nearby residents. Others seek to designate how the electric grid buildout required to serve these centers will be distributed across rate classes, while still others establish specific emissions targets for data centers.[52] [53]

Proposed legislation (113 bills total) was introduced across 30 states. To give a sense of how states are considering addressing the rapid addition of data centers, the chart below highlights a sampling of proposed legislation related to data centers.

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[46] Patel, Sonal. "AEP Ohio Proposes New Utility Tariff for Data Centers to Offset Infrastructure Costs." POWER, October 24, 2024. https://www.powermag.com/aep-ohio-proposes-new-utility-tariff-for-data-centers-to-offset-infrastructure-costs/

[47] Peterson Corio, Amanda, and Briana Kobor. How We're Working with Utilities to Create a New Model for Clean Energy. Google Blog, June 11, 2024. Accessed June 19, 2025. https://blog.google/outreach-initiatives/sustainability/google-clean-energy-partnership/

[48] Skidmore, Zachary. "Indiana Regulators Approve New Rules for Data Centers Seeking Grid Connection." Data Center Dynamics, February 25, 2025. https://www.datacenterdynamics.com/en/news/indiana-regulators-approve-new-rules-for-data-centers-seeking-grid-connection/

[49] Clavenna, Scott. "The Rules Around Data Center Cost Allocation Are Getting Clearer." Latitude Media, February 26, 2025. https://www.latitudemedia.com/news/the-rules-around-data-center-cost-allocation-are-getting-clearer/

[50] Johnson, Khari. Crackdown on Power-Guzzling Data Centers May Soon Come in California. San Francisco Chronicle, February 18, 2025. https://www.sfchronicle.com/bayarea/article/crackdown-power-guzzling-data-centers-soon-come-20173899.php.

[51] Plautz, Jason, and Jeffrey Tomich. "State Lawmakers Grapple with Energy Demand for Data Centers." E&E News by Politico, March 3, 2025. https://www.eenews.net/articles/state-lawmakers-grapple-with-energy-demand-for-data-centers/.

[52] Boudreau, Catherine. "Indiana Is Getting $15 Billion in Big Tech Investment. Residents Don't Want to Foot the Energy Bill." Business Insider, March 4, 2025. https://www.businessinsider.com/indiana-big-techs-ai-data-centers-energy-amazon-google-microsoft-2025-2.

[53] Garden, Leah. "Oregon's Data Center-Focused Emissions Bill Squashed by Amazon." Trellis, March 5, 2025. https://trellis.net/article/oregons-data-center-focused-emissions-bill-squashed-amazon/.

	Limit Cost Impact on other Customers	Revised Electricity Rate Structure	Renewable Electricity Supply	Energy Efficiency Standards	Energy Use Disclosures
CA	AB 222[54] [55]	SB 57[56]	SB 58[57]	AB 222	AB222
CO			SB25-280[58]	SB25-280	
GA	SB34[59]	SB34[60]			
IL		HB3779[61]	HB3779[62]		SB2181[63]
IN					SB135[64]
MN	HF2928[65] & HF16[66]		HF2928	HF2928	HF2928
NJ			S4143[67]		S4143
NY			S06394[68]	S06394	S06394
TX	SB6[69]			SB6	
VA	HB2101[70] & SB 960[71]		HB2578[72]	HB2578	

For a comprehensive overview of legislation pertaining to data centers, refer to ClimateXChange's Data Centers and State Climate Policy Webinar here.

[54] California Legislature. AB-222 Data Centers: Energy Usage Reporting and Efficiency Standards: Electricity Rates. 2025–2026 Regular Session. Accessed June 2, 2025. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202520260AB222

[55] Johnson, Khari. Crackdown on Power-Guzzling Data Centers May Soon Come in California. San Francisco Chronicle, February 18, 2025. https://www.sfchronicle.com/bayarea/article/crackdown-power-guzzling-data-centers-soon-come-20173899.php.

[56] California Legislature. SB-57 Electrical Corporations: Tariffs. 2025–2026 Regular Session. Accessed June 2, 2025. https://leginfo.legislature.ca.gov/faces/billStatusClient.xhtml?bill_id=202520260SB57.

[57] California Legislature. SB-58 Sales and Use Tax Law: Exemptions: Certified Data Center Facilities. 2025–2026 Regular Session. Accessed June 2, 2025. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202520260SB58.

[58] Colorado General Assembly. Senate Bill 25-280: Colorado Data Center Development and Grid Modernization Act. 2025. Accessed June 2, 2025. https://leg.colorado.gov/sites/default/files/documents/2025A/bills/2025a_280_01.pdf.

[59] Georgia General Assembly. Senate Bill 34: Public Service Commission; Costs Incurred by an Electric Utility as a Result of Providing Electric Services to Commercial Data Centers from Being Included in Any Rates; Prohibit. Accessed June 2, 2025. https://www.legis.ga.gov/legislation/69551

[60] Georgia General Assembly. Senate Bill 34: Public Service Commission; Costs Incurred by an Electric Utility as a Result of Providing Electric Services to Commercial Data Centers from Being Included in Any Rates; Prohibit. Accessed June 2, 2025. https://www.legis.ga.gov/legislation/69551

[61] Illinois General Assembly. House Bill 3779: Utility Time of Use Pricing. Accessed June 3, 2025. https://www.ilga.gov/legislation/billstatus.asp?DocNum=3779&GAID=18&GA=104&DocTypeID=HB&LegID=162648&SessionID=114.

[62] Illinois General Assembly. House Bill 3779: Utility Time of Use Pricing. Accessed June 3, 2025. https://www.ilga.gov/legislation/billstatus.asp?DocNum=3779&GAID=18&GA=104&DocTypeID=HB&LegID=162648&SessionID=114.

[63] Illinois General Assembly. Senate Bill 2181: Data Center Reporting. Accessed June 2, 2025. https://www.ilga.gov/legislation/BillStatus.asp?DocNum=2181&GAID=18&DocTypeID=SB&SessionID=114&GA=104.

[64] Indiana General Assembly. Senate Bill 135, Data Center Development. 2025 Reg. Sess. Introduced January 8, 2025. https://iga.in.gov/legislative/2025/bills/senate/135/details.

[65] Minnesota Legislature. HF 2928. 2025. Accessed June 9, 2025. https://www.revisor.mn.gov/bills/text.php?number=HF2928&session=ls94&version=list&session_number=0&session_year=2025.

[66] Minnesota Legislature. HF 16. Accessed June 12, 2025. https://www.revisor.mn.gov/bills/bill.php?b=house&f=HF16&ssn=1&y=2025

[67] New Jersey Legislature. Senate Bill 4143: Requires Energy Usage Plan for AI Data Centers and Cryptocurrency Mining Facilities. 2025. Accessed June 9, 2025. https://legiscan.com/NJ/text/S4143/id/3135244.

[68] New York State Legislature. Senate Bill S6394A: Relates to the Regulation of Energy Consumption by Data Centers. 2025. Accessed June 9, 2025. https://www.nysenate.gov/legislation/bills/2025/S6394/amendment/A.

[69] Texas State Legislature. Senate Bill 6: Relating to Electricity Planning and Infrastructure Costs for Large Loads. 2025. Accessed June 9, 2025. https://legiscan.com/TX/text/SB6/id/3116484/Texas-2025-SB6-Introduced.html

[70] Virginia General Assembly. House Bill 2101: Electric Utilities; Data Center Cost Allocation. 2025. Accessed June 9, 2025. https://lis.virginia.gov/bill-details/20251/HB2101/text/HB2101

[71] Virginia General Assembly. House Bill 2578: Retail Sales and Use Tax; Exemption for Data Centers, Reports. 2025. Accessed June 9, 2025. https://lis.virginia.gov/bill-details/20251/HB2578.

[72] Virginia General Assembly. House Bill 2578: Retail Sales and Use Tax; Exemption for Data Centers, Reports. 2025. Accessed June 9, 2025. https://lis.virginia.gov/bill-details/20251/HB2578.

APPENDIX II: ADDITIONAL EXAMPLES

Hamina, Finland

Google partnered with Haminan Energia, a city-owned energy provider in Hamina, Finland, to launch a heat recovery project that will turn its data center's waste heat into sustainable thermal energy for Hamina residents.[73] According to Google, the data center already uses 97% carbon-free energy. Google will redirect its excess heat into Hamina's district heating network—free of charge—and the district heat network will then use it to supply approximately 80% of its annual heat demand.[74]

London, United Kingdom

Queen Mary University of London now distributes waste heat from its data center to warm buildings on its Mile End campus. This waste heat recovery retrofit also expanded the capacity of the data center, allowing it to support high-performance computing for the university's particle physics research. The system reduces reliance on gas boilers and is expected to cut the university's direct emissions by 625 tonnes of CO_2e annually, adjusted to a net 553 tonnes of CO_2e when accounting for a "modest increase in electricity-related emissions."[75]

Mäntsälä, Finland

A Nebius data center recovers approximately 20,000 MWh of energy annually, heating the equivalent of 2,500 Finnish homes and reportedly cutting energy costs for residents.[76]

Odense, Denmark

Odense is home to "the largest Danish heat pump installation utilising surplus heat from a data centre."[77] Excess heat from Meta's Tietgenbyen data center is redistributed to Odense's district heating network. According to project designer Ramboll in 2023, "Tietgenbyen Energy Centre will provide heat to more than 12,000 homes…reducing the city's reliance on coal, and supporting Fjernvarme Fyn's further goal of providing 100% renewable energy by 2030."[78]

San Jose, California

In downtown San Jose, a proposed development would use waste heat from three planned data centers to heat and cool up to 4,000 new apartments.[79] The project is a partnership between utility Pacific Gas & Electric, the City of San Jose, and developer Westbank, and is meant to address the growing demand for AI-driven data centers while simultaneously advancing San Jose's own net-zero goals.[80] The first data center is expected to come online in late 2027.

Stockholm, Sweden

Stockholm Data Parks is a joint venture between the City of Stockholm, its district energy corporation, the power company, and tech company Stokab. Its vision is "a data center industry where no heat is wasted," and it aims to supply 10% of the city's heating needs through data centers.[81] [82]

Woerden, Netherlands

In Woerden, Netherlands, Switch Datacenters is upgrading its data center with direct-liquid-cooling and replacing gas generator units with heat exchangers that will sell waste heat to the surrounding area.[83] Customers will receive cash incentives equal to 20-30% of their electricity costs

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[73] Townsend, Ben. Our First Offsite Heat Recovery Project Lands in Finland. Google, May 20, 2024. Accessed June 9, 2025. https://blog.google/around-the-globe/google-europe/our-first-offsite-heat-recovery-project-lands-in-finland/

[74] Ibid.

[75] Gooding, Matthew. Queen Mary University of London Uses Data Center Waste Heat to Warm Buildings. Data Center Dynamics, January 8, 2025. Accessed June 9, 2025. https://www.datacenterdynamics.com/en/news/queen-mary-university-of-london-uses-data-center-waste-heat-to-warm-buildings/.

[76] Paulsson, Lars, Kari Lundgren, and Kati Pohjanpalo. Power-Hungry Data Centers Are Warming Homes in the Nordics. Bloomberg, May 13, 2025. Accessed June 9, 2025. https://www.bloomberg.com/news/features/2025-05-14/finland-s-data-centers-are-heating-cities-too.

[77] Kristensen, Tina Kramer. Meta: Surplus Heat to District Heating. Ramboll, 2019. Accessed June 9, 2025. https://www.ramboll.com/projects/energy/meta-surplus-heat-to-district-heating

[78] Ibid.

[79] Pacific Gas and Electric Company. Westbank and PG&E Propose Net Zero Community in Downtown San Jose. November 13, 2024. https://investor.pgecorp.com/news-events/press-releases/press-release-details/2024/Westbank-and-PGE-Propose-Net-Zero-Community-in-Downtown-San-Jose/default.aspx.

[80] Peters, Adele. These Silicon Valley Apartments Will Get Their Heat from Nearby Data Centers. Fast Company, November 15, 2024. Accessed June 9, 2025. https://www.fastcompany.com/91228833/these-silicon-valley-apartments-will-be-heated-by-data-centers.

[81] Stockholm Data Parks. Stockholm Data Parks: Green Computing Redefined. Accessed June 9, 2025. https://stockholmdataparks.com/.

[82] van der List, Bobbie. How Data Centers Can Give Back to Society. Strategy+Business, September 21, 2020. Accessed June 9, 2025. https://www.strategy-business.com/article/How-data-centers-can-give-back-to-society.

[83] Swinhoe, Dan. Switch Datacenters to Heat Homes and Offices Using Residual Server Heat. Data Center Dynamics, January 13, 2021. Accessed June 9, 2025. https://www.datacenterdynamics.com/en/news/switch-datacenters-heat-homes-and-offices-using-residual-server-heat/

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